ANNALS OF THE NEW YORK ACADEMY OF SCIENCES

VOLUME 79, ART. 2, PAGES 9-42

STUDIES ON MARINE BRYOZOA. XI: ANTARCTIC OSTHIMOSIAE

By

MARY D. ROGICK

NEW YORK
PUBLISHED BY THE ACADEMY

June 30, 1959

THE NEW YORK ACADEMY OF SCIENCES
(Founded in 1817)

COUNCIL, 1959

President
HILARY KOPROWSKI

President-Elect
M. J. KOPAC

Vice-Presidents
LYLE BORST
C. P. RHOADS

Recording Secretary
EMERSON DAY

Corresponding Secretary
FREDERICK Y. WISELOGLE

Treasurer
GUSTAV J. MARTIN

Elected Councilors

1957-1959
GEORGE H. MANGUN
MINA REES
HAYDEN C. NICHOLSON
WILLIAM W. WALCOTT

1958-1960
DAVID A. KARNOFSKY
WAYNE W. UMBREIT
GUSTAV J. MARTIN
JOHN E. VANCE

1959-1961
JOHN E. DEITRICK
ROBERT S. MORISON
CHARLES W. MUSHETT
E. L. TATUM

Finance Committee
HARDEN F. TAYLOR, *Chairman*
GORDON Y. BILLARD
ROBERT F. LIGHT

Executive Director
EUNICE THOMAS MINER

SECTION OF BIOLOGICAL AND MEDICAL SCIENCES
ROBERT L. KROC, *Chairman*
CHARLES NOBACK, *Vice Chairman*

DIVISION OF ANTHROPOLOGY
DOROTHY L. KEUR, *Chairman*
DOROTHY CROSS JENSEN, *Vice Chairman*

DIVISION OF INSTRUMENTATION
DUNCAN A. HOLADAY, *Chairman*
ANDRES FERRARI, *Vice Chairman*

DIVISION OF MYCOLOGY
KARL MARAMOROSCH, *Chairman*
EMANUEL GRUNBERG, *Vice Chairman*

DIVISION OF PSYCHOLOGY
GREGORY RAZRAN, *Chairman*
LOUIS W. MAX, *Vice Chairman*

SECTION OF CHEMICAL SCIENCES
KARL FOLKERS, *Chairman*
FREDERICK R. EIRICH, *Vice Chairman*

SECTION OF GEOLOGICAL SCIENCES
KURT LOWE, *Chairman*
FREDERICK P. YOUNG, Jr., *Vice Chairman*

DIVISION OF OCEANOGRAPHY AND METEOROLOGY
ABRAHAM S. KUSSMAN, *Chairman*
CHARLES KNUDSEN, *Vice Chairman*

SECTION OF PHYSICAL SCIENCES
EMANUEL R. PIORE, *Chairman*
E. BROMBERG, *Vice Chairman*

DIVISION OF ENGINEERING
THOMAS B. DREW, *Chairman*

Past Presidents

WILLIAM K. GREGORY
VICTOR K. LAMER
HORACE W. STUNKARD
M. L. CROSSLEY
ROSS F. NIGRELLI
HARDEN F. TAYLOR
BORIS PREGEL

The Sections and the Divisions hold meetings regularly, one evening each month, during the academic year, October to May, inclusive. All meetings are held at the building of The New York Academy of Sciences, 2 East Sixty-third Street, New York 21, New York.

Conferences are also held at irregular intervals at times announced by special programs.

ANNALS OF THE NEW YORK ACADEMY OF SCIENCES

VOLUME 79, ART. 2, PAGES 9-42

June 30, 1959

STUDIES ON MARINE BRYOZOA. XI: ANTARCTIC OSTHIMOSIAE

By

MARY D. ROGICK

College of New Rochelle, New Rochelle, N. Y.

NEW YORK
PUBLISHED BY THE ACADEMY

STUDIES ON MARINE BRYOZOA. XI: ANTARCTIC OSTHIMOSIAE

Mary D. Rogick

College of New Rochelle, New Rochelle, N. Y.

Introduction

The purposes of this paper are, first, to report the occurrence of four celleporid species of the genus *Osthimosia* from new and more southerly localities in the Antarctic; second, to clarify ambiguous and hitherto troublesome points about their anatomy and synonymy; third, to refine or amplify the descriptions of these four species; fourth, to supply far more adequate illustrations and measurements for each; and, fifth, to revise or emend the genus *Osthimosia*, which has been the subject of controversy since its erection in 1888.

The specimens on which this study is based were collected by the Antarctic expedition of the United States Navy in 1947 and 1948 (Commander David C. Nutt, collector) and have been kindly loaned to me by the Smithsonian Institution, United States National Museum (U.S.N.M.) Washington, D.C. They are now on file there (Accession No. 177438).

The contraction USN will be used in referring to the species of the present collection to distinguish them from specimens collected by other Antarctic and Sub-Antarctic expeditions such as the *Challenger*, *Charcot*, and *Belgica*. Fuller data on each USN collecting station were reported in an earlier paper (Rogick, 1956*b*, pp. 222-223).

A glossary has been appended since bryozoan terminology has become not only very specialized but sometimes quite confused, and definitions are not available in ordinary texts. TABLE 1 shows the classification of the genus under discussion.

TABLE 1

CLASSIFICATION

(After Bassler, 1953)

Phylum Bryozoa
Subphylum Ectoprocta
Class Gymnolaemata
Order Cheilostomata
Suborder Ascophora
Family Celleporidae Busk 1852
Genus *Osthimosia* Jullien 1888

Genus *Osthimosia* Jullien 1888

*The work reported in this paper has been supported for several years by grants from the National Science Foundation, Washington, D. C.

History. Jullien (1888, p. 64) erected the genus *Osthimosia* and the family Osthimosidae to accommodate the two new species *O. otopeta* and *O. evexa* and also apparently, to displace the genus *Cellepora* of Fabricius. Jullien's definition of the genus *Osthimosia* stressed the notched orifice, the marginal pores (origelles), the cylindrical aviculiferous peristome, the close relation between ovicell and peristome, the presence of vicarious avicularia, and the lack of oral spines. He described both species as having these characteristics, except that vicarious avicularia were absent from the single sample of *O. otopeta* at his disposal.

In both species he noted an ovicell whose inner ovicell layer (entooecium) was entire and unpunctured, and whose outer layer (ectooecium) had a frontal gap. This characteristic Jullien did not emphasize in his definition of the genus, but he did mention it under each species.

Levinsen (1909, p. 347) however, considered the ovicell condition of such importance that he erected the new genus *Siniopelta* to accommodate species in which the ovicell had an entooecium with a "flat frontal area furnished either with radiating fissures or with pores and covered by a membranous part of the ectooecium." His definition of the genus stressed only the nature of the ovicell and did not include an account of the peristome, orifice, or avicularia. Levinsen split the genus *Osthimosia* into the genera *Cellepora* and *Siniopelta.*

Opinions of eminent bryozoologists differ as to which of the two genera, *Osthimosia* or *Siniopelta,* is valid. Bassler (1953) favors *Osthimosia;* Marcus (1938) *Siniopelta;* Brown (1952, p. 365) grants that *Osthimosia* appears to be a distinct genus, but places *Cellepora granum* in the genus *Celleporina* Gray 1848 instead of in *Osthimosia.*

The most recent definition of *Osthimosia* is that given by Bassler (1953, p. G220): "Thick branches. Zooecia with pleurocyst; frontal surrounded by areolae; aperture with proximal rimule, no spines." That leaves the genus definition still too broad.

The easiest solution to the problem, since the genus *Osthimosia* seems to be a perfectly recognizable one, and since Levinsen merely emphasizes a particular feature of it, namely, the nature of the ovicell, in erecting *Siniopelta,* is to emend the definition of the genus *Osthimosia* to include Levinsen's concept and to add further distinctive features that have come to light during the study of current USN specimens. Therefore, the revised or emended definition of *Osthimosia* should be as follows:

Genus *Osthiomosia,* Emended

Definition. Celleporids having an orbicular to suborbicular primary orifice with a median V-shaped incision in the lower lip, with a tall urceolate to partial or complete more or less cylindrical aviculiferous peristome.

Peristomial avicularial chambers tubular. Vicarious avicularia present and one larger than the peristomial ones. Marginal pores, sometimes prolonged into tubes, are generally present, at least in some zooecia. Zooecia erect in crowded parts of the colony, more decumbent at its margins. Ovicells globose, smooth, with the ectooecial layer having a gap or interruption of varied shape or size frontally, exposing the unpunctured entooecial layer. The unpunctured area or tabula is usually set off in some way, either by salient border or slight radiating lines. True spines are lacking on ordinary zooecia, but are present on the ancestrula.

Discussion. The emendations include, in addition to the very distinctive nature of the ovicell with its nonporous tabula (see FIGURES 9, 18, 31, and 43), the long tubular peristomial avicularial chambers (see FIGURES 8, 20, 32, and 52), and the spined nature of the ancestrula. The ancestrula differs considerably in appearance from the other zoids of a colony. It has a good-sized membranous area (opesium) surrounded by several long slender spines (FIGURE 29).

The following six species should be placed in the emended genus *Osthimosia: Cellepora ansata* Busk 1881, *C. bicornis* Busk 1881, *C. eatonensis* Busk 1881, *C. granum* Hincks 1881, *C. milleporoides* Calvet 1909, and *C. tiara* MacGillivray 1887. Other species had been placed into *Osthimosia* by various authors in the past, but a re-examination of those is beyond the scope of the present paper.

Canu and Bassler (1920, p. 601) listed the genotype of *Osthimosia* as *O. eatonensis* (Busk), which is equivalent to Jullien's *O. evexa.*

The two original species for which Jullien erected the genus, *O. otopeta* and *O. evexa,* are synonyms of Busk's 1881 *Cellepora bicornis* and *C. eatonensis,* respectively, although Jullien understandably did not realize it. Jullien had only one worn or damaged sample of *O. otopeta,* to judge from his Plate 1, FIGURE 3. As for the specimen of *O. evexa,* Busk's 1884 illustrations (Plate 29, FIGURE 4 and 5*a)* of *C. eatonensis* are misleading as regards the peristome. Busk himself was somewhat uncertain as to whether he was dealing with a single species (*C. eatonensis)* or with three separate species (*C. magellensis, C. rostrata,* and *C. eatonensis* var. *magellanica),* but he finally decided that it was all one variable species: *C. eatonensis.* Moreover, Busk did not describe or figure the ovicells, a critical omission that caused considerable difficulty for later authors. Consequently, it is understandable that Jullien did not recognize his own specimens as identical with those of Busk.

Because of the obscurity of Busk's account of *C. eatonensis,* the same complication arose in identifying the USN specimens. It was not until the works of Waters (1888, pp. 34, 35; 1900, p. 96; 1904, p. 74), Hincks (1892), p. 156), Calvet (1904, p. 32), Brown (1952, p. 365), and others were care-

fully studied that it was possible to classify the USN specimens as *O. eatonensis*. The critical diagnostic points missing from Busk's account were the true nature of the peristome and ovicell. These points were fairly well settled, though not illustrated, by Waters' examination of Busk's museum specimens and by Brown's substantiation of Waters' findings. Waters asserted (1904, p. 74) that Jullien's *O. evexa* was Busk's *C. eatonensis*.

The true identity of Jullien's *O. otopeta* as a synonym of Busk's *C. bicornis* was not evident to the earlier workers and was not suspected until a careful study was made of the current USN specimens of *O. bicornis*. It then became apparent that Jullien's lone sample must have been a worn or damaged specimen of *O. bicornis*.

The genus still presents a problem because it contains two diverse species groups: the *bicornis* group and the *eatonensis* group. To the former belong *O. bicornis* and *O. ansata;* to the latter group belong *O. eatonensis, O. granum, O. milleporoides,* and *O. tiara.* The *bicornis* group has two peristomial avicularia placed bilaterally, while the *eatonensis* group has a single median proximal peristomial avicularium and a somewhat more typical ovicell. It may be necessary to erect a separate genus for the *bicornis* group but, for the present, *bicornis* remains in the genus *Osthimosia.*

The number of celleporid species in the USN collection which is smaller than expected, includes these four; *O. bicornis, O. eatonensis, O. granum,* and *O. milleporoides.* All have been reported accurately only from the southern hemisphere. A key to these four species is shown in TABLE 2.

TABLE 2

Key to USN *Osthimosia* Species

(1)	Two peristomial avicularia per zoid, one atop each side of the peristome	*O. bicornis*
(2)	Single median proximal peristomial avicularium	3 or 6
(3)	Vicarious avicularia short, broadly oval	4 or 5
(4)	Ovicell completely decumbent, at right angles to and the same height as the peristome. Tabula crescentic	*O. milleporoides*
(5)	Ovicell erect. Peristome much taller than ovicell. Tabula hemispherical	*O. granum*
(6)	Vicarious avicularia long, narrow, decidedly spatulate at tip. Ovicell erect. Tabula trianguloid	*O. eatonensis*

Osthimosia bicornis (Busk) 1881

(TABLES 3 and 4; PLATE 1, FIGURES 1 to 15)

Diagnosis. Zoarium burrlike. Zooecia expanded below, narrowed upward. Occasional pores near the base. Primary orifice rounded, with a broad notch in its lower border. Peristome tall, bicornute, with a tiny oval avicu-

larium having a trianguloid mandible atop each horn. Two (or more?) other sharp peristomial projections present. Peristomial avicularial chamber is long, narrow, clavate, and vertical to oblique in direction. Large vicarious spatulate avicularia are present. Ovicell smooth, globular, decumbent, with a small pit or pore of variable shape in the ectooecium. Ancestrula has approximately 9 spines. The measurements of the various parts are given in TABLE 4.

Zoarium. The biggest colony is a prickly white burr about 7 mm. in diameter. The zooecia are crowded together and upright. Their basal surfaces are calcified and polygonal (PLATE 1, FIGURE 13). The pattern of budding is more or less spiral (PLATE 1, FIGURES 1 and 9). Silén (1942, pp. 19-20) studied the spiral budding of *Cupularia, Cupuladria, Heliodoma,* and *Setosella,* suggesting that it might be the best mode of growth for zoaria attached to small substrates. Even if there is sufficient space for the zoids to grow in any direction on other bryozoa and hydroids, *O. bicornis* zoids still grow in crowded fashion.

Zooecia. The flask-shaped zooecia are erect, expanded below, tapered gradually toward the primary orifice, then flared out slightly upward.

The zooecial surface is generally smooth, but it may sometimes be faintly mammillate here and there. A few small rounded and widely spaced areolar pores encircle the base.

Peristome. The peristome flares up gracefully from around the primary orifice like the neck of a vase (PLATE 1, FIGURE 6). In non-ovicelled zooecia it is complete in that it encircles the entire primary orifice (PLATE 1, FIGURE 4). In ovicelligerous zooecia the peristome is incomplete or cut away at the back to end abruptly in front of the ovicell sides, thus allowing space for the bulky ovicell (PLATE 1, FIGURE 6).

The peristone is produced into two horns and several sharp jagged points (PLATE I, FIGURE 4). These horns give the species its name, *O. bicornis.* Busk (1884, PLATE 30, FIGURE 12*b*) called attention to two to four "spines" (points), but the USN specimens generally had two in mature colonies but none yet in young colonies.

The two horns are hollow, thicker than the points, and are aviculiferous. The peristome is thinner and lower in front between the two horns than at the sides. In this respect *Osthimosia bicornis* (Busk) 1881 differs completely from the *Lepralia bicornis* Busk 1859 that Lorenz (1886) and Bidenkap (1905) listed as *Cellepora bicornis,* The *Lepralia bicornis,* which since has been shifted to other genera, has a thick median nonavicularious third horn between the two lateral horns.

As already stated, the peristomial horns are hollow, and each continues as a long, slender, vertical-to-oblique tube from the free to the attached surface of the peristome and even beyond that for a short distance down

the sides of the zooecium (PLATE 1, FIGURES 4 and 8). Near the top the tube is expanded slightly to form a clavate avicularial chamber.

Avicularia. Two kinds of avicularia are present: the small peristomial type and the large vicarious type. Busk (1881b, p. 359) calls the former type "oral," although in actuality it has nothing to do with the true mouth. Since it would be more accurate and descriptive to call it peristomial, this term will be used. Every *O. bicornis* zooecium has two peristomial avicularia, but a colony has only a few vicarious avicularia.

Each peristomial avicularium is oval, points outward from the primary or secondary orifices, and perches atop the peristome horn (PLATE 1, FIGURES 4 and 5). Its mandible is lightly chitinized, with a thinner oval space called the lucida. The mandible is trianguloid, that is, has its corners rounded (PLATE 1, FIGURE 15).

Delicate muscles attach it to the wall of the clavate avicularial chamber The chamber houses avicularial glands and the mandibular musculature. Both of these are smaller and less conspicuous than the glands and muscles of *Hippadenella carsonae* (Rogick, 1957b, p. 124, FIGURE 4).

The vicarious avicularia are separate entitles, interspersed here and there among the regular zoids of the colony (PLATE 1, FIGURES 1 and 10). They are few in number, much larger than the peristomial avicularia, and the chamber of each has a few large areolar pores about the base. Each vicarious avicularium is topped by a large delicate spatulate mandible and a small hemispherical back area (PLATE 1, FIGURE 12). The latter slants downward away from the plane of the mandible. The mandibles of both avicularial types agree with those pictured by Busk.

Orifice. The secondary orifice (peristomice) is the uppermost area enclosed by the free rim of the peristome. It is the entrance to the peristomie, or lumen of the peristome. The primary orifice is the true zooecial aperture at the bottom of the peristomie and is hard to see when the peritome is tall (PLATE 1, FIGURES 8 and 9).

The primary orifice is orbicular with a wide notch or sinus in its proximal border. Its inner and outer surfaces differ slightly in shape. The sinus is wider and much shallower on the outer surface. The sinus is constricted or limited internally on each side by a prominent tooth (cardelle) that projects from the inner surface of the orifice and with which the operculum articulates (PLATE 1, FIGURE 11).

The operculum is shaped to fit the orifice; therefore, its outer and inner surfaces differ in shape (PLATE I, FIGURE 2). In older zoids it is more heavily chitinized, and articular areas are more prominently outlined than in the young. Delicate occlusor muscles attach in two small patches or dots on its inner surface.

Ovicell. The ovicells are globose but flattened from front to back and somewhat decumbent, that is pushed back away from the peristomie

(PLATE 1, FIGURES 1, 6, and 9). Their surface is smooth, not mammillate, and may show differences in thickness and some irregularities or rippling, especially about the tabula. The calcareous wall is double. Frontally, there is a gap or shallow crater in the ectooecium or outer layer. This gap corresponds to the "area" or "tabula" of Waters (1913, p. 511). The extremely fragile floor of this tabula is formed by the entooecium or inner layer and is often broken in specimens, so that the ovicell may have a pore of variable size and shape (rounded, oval, triangular, or irregular) there. The ovicell wall has no other pores.

Distribution and ecology. The USN specimens of *O. bicornis* came from Antarctic Stations Nos. 44 and 45, from the Wilkes Land Area; No. 104, from the Ross Sea Area; No. 115, from the Knox Coast Area; and Nos. 190 193 and 234, from the Marguerite Bay. More complete data on each station have been presented in a previous publication (Rogick 1956b, pp. 222 and 223). The amount of material from each station was small.

The USN colonies grew on calcareous worm tubes, hydroids, on the following bryozoan species: *Cellaria moniliorata* (Station 104), *Clithriellum inclusum* (Station 45), *Hippadenella carsonae* (Station 104), *Mawsonia extensalata* (Station 190), *Phylactellipora lyrulata* (Station 234, and on others yet to be carefully studied.

The present records extend the eastern and southern ranges or limits of this species considerably beyond those indicated by Busk, Calvet, Jullien, and Waters. Thus, the USN collections extend the range from long. 68° 30' W. (Marguerite Bay Stations) to 166° 13' E. and down to lat. 77° 30' S. (Station 104). The USN specimens came from depths of 35 to 100 fathoms, while Busk's came from depths of 50 to 150 fathoms. Some of Calvet's specimens came from shallower waters.

To date, this species has not been found in the northern latitudes, and the amounts of material collected from the Antarctic and Sub-Antarctic have been slight. Because of the small size of the colonies this species can be easily overlooked. In so far as is known at present, therefore, *Osthimosia bicornis* is circumpolar and limited to the southern hemisphere.

TABLE 3

OSTHIMOSIA BICORNIS (BUSK) 1881

SYNONYMY AND PREVIOUS DISTRIBUTION RECORDS

1881a. *Cellepora bicornis*. Busk, pp. 354-355. Challenger Sta. No. 150 (Lat. 52°4'S., Long. 71°22'E.), 150 fathoms; Prince Edward Island, 80-150 fathoms.

1881b. *Cellepora bicornis*. Busk, p. 362; Pl. 27, Fig. 4.

1884. *Cellepora bicornis*. Busk, pp. 191, 202; Pl. 30, Figs. 1, 12; Pl. 36, Figs. 13, 15. Additional *Challenger* Sta. Nos. 313, 314 (between Magellan Straits and the Falkland Islands), 55-70 fathoms; Marion Island, 50-75 fathoms.

1888. *Cellepora bicornis*. Waters, p. 35. *Challenger* Sta. No. 151 (Lat. 52°59'S., Long. 73°33'E.), 75 fathoms.
1888. *Osthimosia otopeta*. Jullien, pp. I.64-I.65. Pl. 1, Fig. 3. Terre de Feu, ile Hoste, baie Orange.
1892b. *Cellepora bicornis*. Hincks, pp. 330-331.
1904. *Cellepora otopeta*. Calvet, pp. 31-32. Straits of Magellan; Picton Isle; South Atlantic Ocean off East Patagonia.
1938. *Siniopelta bicornis*. Marcus, p. 50
1952. *"Cellepora" bicornis*. Brown, p. 371
1956a. *Cellepora bicornis*. Rogick, p. 74. Sta. 45 Wilkes Land Area.

Not the Following

1886. *Cellepora bicornis*. Von Lorenz, p. 97
1905. *Cellepora bicornis*. Bidenkap, pp. 34, 62, 63

TABLE 4

MEASUREMENTS OF THE PARTS OF OSTHIMOSIA BICORNIS (BUSK) 1881*

0.464 – 0.580	(0.531)	D	Zooecia at widest point, as seen from above
0.187 – 0.274	(0.239)	L	Ovicell from top view
0.216 – 0.288	(0.258)	W	Ovicell
0.333 – 0.493	(0.422)	L	Peristomial avicularial chamber
0.043 – 0.058	(0.057)	W	Peristomial avicularial chamber at widest, clavate part of tube
0.137 – 0.173	(0.158)	L	Primary orifice of nonovicelled zooecia, sinus included
0.115 – 0.144	(0.124)	W	Primary orifice of nonovicelled zooecia
0.216 – 0.406	(0.338)	L	Spatulate vicarious avicularia
0.130 – 0.267	(0.167)	W	Spatulate vicarious avicularia
0.050 – 0.079	(0.066)	L	Peristomial avicularia
0.043 – 0.058	(0.050)	W	Peristomial avicularia
0.029 – 0.040	(0.036)	L	Peristomial avicularium beak, the part covered by the mandible
0.029 – 0.044	(0.035)	W	Peristomial avicularium beak, the part covered by the mandible
0.019 – 0.044	(0.034)	L	Primary orifice sinus (6 readings)
0.025 – 0.044	(0.033)	W	Primary orifice sinus (6 readings)

*The first figures are the minimum, the next the maximum readings, and the last, in parentheses, are the average of all readings, 10 for each structure unless otherwise specified. Readings are in millimeters. Length, width or breadth, height, and diameter are abbreviated to L, W, B, H, and D. No measurements exist in previous accounts of this species.

Osthimosia eatonensis (Busk) 1881

(TABLES 5 and 6; PLATE 2, FIGURES 16 to 26)

Discussion. The USN *Osthimosia eatonensis* was difficult to identify because, although its vicarious and peristomial avicularia, mandibles, and opercula corresponded completely with those illustrated by Busk (1884) for *Cellepora eatonensis*, its peristome was like that of Busk's *Cellepora canaliculata* (1884, PLATE 30, FIGURE 5). However, Busk apparently had not seen the ovicells of either form and, since ovicells are extremely

important in classification, the absence of ovicell data from Busk's account made identification of the USN specimens troublesome. Moreover, *C. canaliculata* is a northern-hemisphere form, while *C. eatonensis* is a southern form.

To complicate matters, the full lateral extent of the peristome around the zooecial orifice was not indicated in Busk's figures (1884, PLATE 29, FIGURES 4 and 6*a*). The cited figures seem to show only the peristomial avicularial chambers or tubes rather than the whole peristome and are somewhat deceiving even for these structures.

Waters' re-examination of Busk's collection clarified some of these unsettled points. Waters described (1888, pp. 34 and 35) but did not illustrate the missing *C. eatonensis* ovicells and commented on (1904, p. 74) the presence of the peristomial wings or lateral extensions of the peristome in some of Busk's species. In the meantime, Hincks (1892a, p. 156) described but did not illustrate ovicells of *C. canaliculata*.

Osthimosia eatonensis presents a slightly different problem in addition to lack of original ovicell figures, namely its variability. Busk himself was uncertain whether he was dealing with a single species or with three different ones. He wrote (1884, p. 202): "At first I was disposed to divide the form into three species, *Cellepora eatonensis, C. magellensis* and *C. rostrata,* but I am now quite satisfied that they are all specifically identical." However, he did not mention what particular features other than the variability of the preoral rostrum or peristome troubled him.

Two of the particularly variable features of the USN specimens are the height of the peristome and that of its avicularial chamber. In some zooecia this chamber is quite prolonged, while the peristomial wings on each side of it are not as long or as tall.

Another variable feature is the degree of transparency or opacity of the of the zooecial walls. In some colonies the zooecial walls are very fragile, thin, and quite hyaline (FIGURE 22). In other colonies the walls are thicker, more opaque, somewhat sparsely pebbled in texture; sometimes the pebbling extends even up along the peristome (FIGURES 16 and 20).

Diagnosis. The colony is compact, encrusting, and ivory-colored. Zooecia are distinctly areolated, expanded below, contracted at neck. An incomplete spoutlike peristome extends from the front and sides of the neck. The spout has a long tubular median avicularial chamber topped by a small rounded avicularium with hemispherical mandible. Zooecial surface and part of peristome may even become pebbly in texture in some colonies. Primary orifice suborbicular, its lower border with a median notch. The ovicell is smooth and erect, with trianguloid nonperforate frontal tabula. The vicarious avicularia are very large and narrowly spatulate. The ancestrula has about eight long, thin spines. The measurements of the various parts are given in TABLE 6.

Zoarium. The colony forms compact encrusting clumps of variable shape on such substrates as bryozoa, calcareous worm tubes, hydroids, spicules of sponges, and alcyonarians. The largest colony measures 20 × 20 × 18 mm.

Where the colony has enough space for unrestricted growth it is flabellate, the zooecia of the basal layer being elongated, decumbent, and attached for the greater part of their length. Soon new zooecia arise from between those of the basal layer to form a more erect stratum. Zooecia at the margin of the colony are decumbent.

Zooecia, ovicells, and large vicarious avicularia crowd together and are oriented in various directions in the older parts of a colony (FIGURE 16).

Zoeecia. The zooecia are swollen basally and narrowed toward the primary orifice. An incomplete peristome encircles the front and sides of the orifice. It is extended into a long, stout hollow process situated just before the orifice sinus. This process is an avicularial chamber that is closed by a rounded avicularium with a semicircular mandible. A much thinner calcareous lamina, diminishing in size, extends from each side of this chamber and extends around the sides of the orifice (FIGURES 18, 19, and 20). These peristomial wings do not form the free jagged points that characterize peristomes of *Osthimosia bicornis* and *O. granum.*

The thinness and translucency of the zooecial walls may vary. Sometimes the walls and peristome are translucent, fragile, and faintly lined: at other times they are thicker, more opaque, and slightly pebbled (FIGURES 20 and 22).

A row of rather large areolar pores punctures the zooecial front peripherally about the base. These pores are particularly noticeable in decumbent zooecia (FIGURE 21), but become disrupted, reduced, or overgrown in crowded zooecia.

Avicularia. Two types of avicularia are present: the small rounded peristomial type and the huge spatulate vicarious type. Each zooecium has one of the former type.

The vicarious avicularia are elevated and scattered haphazardly over the colony among the zooecia, and some of them appear to be larger than the regular zooecia. The elevated face of each is long and narrow, with a rounded beak that has a partial upright retaining wall about it. The opposite end of the vicarious avicularium (the so-called back area) slants downward in a plane different from that of the mandible, as shown in FIGURE 16.

The mandible of the peristomial avicularium is hemispherical, with reinforced rim, rounded lucida, and two approaching supports (FIGURE 23). The mandible of the vicarious avicularium is yellow, long, and spatulate, with a lucida and chitinized reinforcements (FIGURE 26).

Orifice. There seems to be no appreciable difference in size or shape between the primary orifices of ovicelled and nonovicelled zoids. In this respect *O. eatonensis* differs from *O. milleporoides,* so that if ovicells are

damaged or destroyed the colonies can still be distinguished on the basis of their orifices, particularly if the colony fragment is so small that no vicarious avicularia are in it.

The primary orifice of *O. eatonensis* is shielded by a peristome. The sides and distal border of the orifice form approximately two thirds of a circle, while the proximal one third consists of the flattened ledges separated by a wide median sinus (FIGURE 19).

The operculum is delicate, with slender reinforced rim and two muscle attachment dots (FIGURES 24 and 25).

Ovicells. The ovicells are globose, smooth, erect, and are provided with a large, frontal tabula (FIGURES 16, 18, 20 and 21). The tabula is generally imperforate and more or less trianguloid. It may show occasional faint peripheral streaks, depending on its degree of calcification, but it is usually rather smooth.

The ovicells of *O. eatonensis* and *O. milleporoides* can sometimes be confusingly similar in appearance. Usually, however, they differ in angle and position with respect to the peristome and in the shape of the tabula and of the secondary orifice.

Distribution and ecology. Osthimosia eatonensis is a very widely distributed circumpolar folm and, insofar as is known at present, it is restricted to the southern hemisphere. Colonies were found at the following USN Antarctic stations: No. 44 (Wilkes Land area), No. 104 (Ross Sea area), No. 115 (Knox Coast), No. 162 (Peter I Island), Nos. 190, 192, 225, 226, 229, 233, 234, 236, 238, and 243 (all from Marguerite Bay) and Case 1 (station unknown). The southern range of this species has been considerably extended by these finds.

Colonies were growing on a number of other bryozoan species. At Station 104 they were on *Camptoplites* sp., *Cellaria vitrimuralis, Clithriellum inclusum, Escharoides bubeccata, Hippadenella carsonae, and Notoplites tenuis.* At Station 190 they grew on a fragment of *Mawsonia extensalata.*

Some of the large spatulate mandibles of the vicarious avicularia were clamped down on Foraminifera and on wads of debris.

The USN specimens came from depths of 30 to 100 fathoms. Those of the *Challenger* came from depths of 5 to 120 fathoms, except for specimens that came from *Challenger* Station 303, whose depth was 1325 fathoms. There is some doubt about the accuracy of this last citation. Waters (1904, p. 74, footnote) tells of re-examining some of Busk's original material "from [Station] 303 (which Sir John Murray thinks may be [Station] 308." A depth of 1325 fathoms was listed for Station 303, but only 175 fathoms for Station 308 by Waters (1888, p. 36).

Of the four *Osthimosia* species in the USN collection, *O. eatonensis* formed the largest colonies and was the most abundant, although the number of colonies from any single station was rather small.

TABLE 5

OSTHIMOSIA EATONENSIS (BUSK) 1881

SYNONYMY AND PREVIOUS DISTRIBUTION RECORDS

1881a. *Cellepora eatonensis.* Busk, pp. 351-352. *Challenger* Sta. 303 (Lat. 45° 31'S., Long. 78° 9' W.) 1325 fathoms; Stations 315 (Lat. 51° 40'S, Long. 57° 50'W) 5 to 12 fathoms; Station 149D and 149I Kerguelen, 20 to 120 fathoms.

1881a. *Cellepora magellensis. Cellepora rostrata.* Busk, p. 352.

1881b. *Cellepora eatonensis.* Busk, PLATE 27, FIGURES 2, 3, and 6.

1881b. *Cellepora eatonensis* var. *magellanica.* Busk, PLATE 27, FIGURE 5

1884. *Cellepora eatonensis* var *magellanica.* Busk, p. 192.

1884. *Cellepora eatonensis.* Busk, pp. 201 and 202; PLATE 29, FIGURES 4, 6, and 8; PLATE 36, FIGURES 3, 4, and 5.

1884. *Cellepora magellensis, Cellepora rostrata.* Busk, p. 202.

1888. *Cellepora pumicosa* var. *eatonensis.* Waters, p. 35.

1888. *Osthimosia evexa.* Jullien, p. I.65; PLATE 1, FIGURE 4; PLATE 13, FIGURES 1 to 4. Terre de Feu, ile Hoste, baie Orange.

1900. *Cellepora eatonensis.* Waters, p. 96.

1904. *Cellepora eatonensis.* Calvet, p. 32. Smyth Channel, 8 to 10 fathoms; South Atlantic Ocean, Kap Blanco, East Patagonia, 80 fathoms; East Patagonia (Lat. 44° 14'S., Long. 61° 23' W.), 60 fathoms.

1904. *Osthimosia eatonensis.* Waters, p. 74.

1909. *Cellepora eastonensis.* Calvet, pp. 37-38. Port Charcot, 40 m., Schollaert Bay, 30 m., Booth Wandel Island, 40 m.

1924. *Cellepora eatonensis.* Thornely, p. 17. Commonwealth Bay, 45 to 50 fathoms; Station 3. (Lat. 66° 32'S., Long. 141° 39'E.) 157 fathoms.

1928. *Osthimosia eatonensis.* Livingstone, pp. 7, 8, 9, and 75.

TABLE 6

MEASUREMENTS OF THE PARTS OF OSTHIMOSIA EATONENSIS (BUSK) 1881

0.245	– 0.274	(0.264)	L	Ovicell
0.259	– 0.331	(0.284)	W	Ovicell
0.130	– 0.160	(0.146)	L	Primary orifice, including sinus, of ovicelled zoid
0.130	– 0.158	(0.146)	W	Primary orifice of ovicelled zoid
0.144	– 0.173	(0.158)	L	Operculum
0.144	– 0.173	(0.158)	W	Operculum
0.072	– 0.101	(0.086)	L,	also W, of peristomial avicularium
0.048	– 0.073	(0.057)	L	Mandible of peristomial avicularium
0.065	– 0.102	(0.078)	W	Mandible of peristomial avicularium
0.252	– 0.637	(0.477)	L	Vicarious avicularium
0.180	– 0.288	(0.244)	W	Vicarious avicularium
0.173	– 0.432	(0.343)	L	Mandible of vicarious avicularium
0.151	– 0.259	(0.199)	W	Mandible of vicarious avicularium
0.638	– 0.798	(0.718)	L	Zooecium
0.334	– 0.493	(0.423)	W	Zooecium

Osthimosia granum (Hincks) 1881
(TABLES 7 and 8; PLATE 3, FIGURES 27 to 42)

Diagnosis. Color White. Zoarium fragile, with erect, bottle-shaped zooecia. Very tall peristome, incomplete in back. The long narrow median avicularial chamber is tubular and clavate. It is topped by a small oval peristomial avicularium with a hemispherical mandible. Peristome sides raised into points. Base of peristome bilaminate. Primary orifice suborbicular, with wide median sinus. Ovicell globose, flatter in front, with an imperforate hemispherical tabula, partly hidden by the peristome. Vicarious avicularia broadly spatulate. Ancestrula with about 7 spines. The measurements of the various parts are given in TABLE 8.

Zoarium. Bubbly white hyaline colonies of *Osthimosia granum* form on various substrates. Such colonies are generally less than 3 mm. in diameter. The soft parts (polypides and brown bodies), opercula, and mandibles are present in some colonies, but not in satisfactory condition for drawing. A few embroyos are in ovicells of Station 226 material.

Zooecia. The extremely fragile thin-walled zooecia are crowded, erect and quite distinct from each other and are shaped like bottles. Their free walls are smooth and generally imperforate. A tall trowel-like peristome has a bilaminate origin from the narrow neck.

Peristome. The peristome is incomplete in both ovicelled and nonovicelled zoids, circling the front and sides, but generally not extending to the back of the primary orifice. The peristome in some places is very thick and glassy (FIGURE 34); in other places it is fragile and bilaminate. It is thickest at the lateral extremities and in the midline. It is bilaminate about its base and has a distinct space between the two laminae (FIGURE 38). It is expanded in the midline by a long slender clavate avicularial chamber that is straight or slightly curved proximally (FIGURES 26, 32), but not nearly so decidedly as that of *Lagenipora nitens* (MacGillivray, 1888, PLATE 156, FIGURES 3, 3a, and 3b; pp. 209 and 210), which has a somewhat spiral twist to its chamber.

In *O. granum* the avicularial chamber forms from the inner lamina (FIGURE 38).

The highest part of the peristome is sometimes the avicularium; at other times it is the lateral wings (FIGURE 32). The peristome usually grows taller than the ovicell, thus concealing the ovicell front and the primary orifice.

Avicularia. As in the two preceding species, two types of avicularia are present in *O. granum:* the small oval peristomial type and the only slightly larger vicarious spatulate type (FIGURES 41 and 42). One peristomial avicularium is present on every zoid, but only a few vicarious avicularia appear in a colonv.

The peristomial avicularia sit atop the decidedly clavate avicularial chamber. Their mandible is more or less hemispherical.

Vicarious avicularia were not mentioned in Hincks' original account (1881b), but Busk's *Challenger* specimens had a few, so Busk added a figure of their mandible (1884, PLATE 36, FIGURE 10).

The vicarious avicularia have their own cone-shaped mound for support and are sporadically located between the bases of the zooecia as a separate individuals. They are somewhat larger than the peristomial avicularia and have spatulate mandibles. Some colonies seem to lack them; others have several.

Orifice. The primary orifice is similar to that of *O. bicornis*. It is rounded and has a wide proximal sinus limited internally by cardelles.

The operculum is operated by very thin and delicate occlusor muscles whose attachment dots are only occasionally distinguishable.

This must be a very interesting species in life because the great height of the peristome presents a problem in food-getting. Although no data are available on the length of the tentacles and tentacle sheath, these must be considerable.

Ovicell. The ovicell is globose, imperforate, more or less smooth, and only slightly tipped rearward. Frontally, the tall peristome shields it. The upper front of the ovicell has a transverse semilunar to hemispherical tabula or gap in its ectooecium, but the underlying thin entooecium is not perforated, although Busk mentioned perforations in his material (1884, p. 205). The ovicell orifice is completely hidden from view by the protecting peristome and can be seen only when the latter is broken away from it. (FIGURES 30 and 31). A few ovicells had amber-colored embryos, one per ovicell. The embryos were not large enough to fill the ovicell (FIGURE 35).

Ancestrula. The ancestrula or first zoid of a colony looks very different from the other zooecia. It is somewhat bullet-shaped, has its broad end cut off obliquely, and is topped by about 7 long thin spines. The ancestrula wall differs from those of the other zoids of the colony in its texture and by its slightly greater opacity.

Distribution and ecology. The *O. granum* specimens studied by Hincks (1881b) and by Busk (1884) came from the Bass Straits, between Australia and Tasmania. Those reported by MacGillivray (1888) also came from Australia, while those of Waters came from Cape Horn. Insofar as can be determined, these were the only unquestioned Recent finds of this species until the present report.

The USN specimens came from Antarctic Stations Nos. 104, 190, 226, 229, and 243. The first station is from the Ross Sea Area, the others from Marguerite Bay. The USN species came from depths of 35 to 58 fathoms. The present finds considerably extend the southern range of this southern hemisphere. Pacific Ocean species.

Colonies of *O granum* encircled sponge spicules, alcyonarians, and hydroids, and grew on such bryozoans as *Notoplites tenuis* (Station Nos. 226 and 229) and a *Caberea* (Station Nos. 226 and 243).

The amount of material collected was scant, and the colonies were few and small.

TABLE 7

OSTHIMOSIA GRANUM (HINCKS) 1881

SYNONYMY AND PREVIOUS DISTRIBUTION RECORDS

1881b. *Cellepora granum*. Hincks, p. 127; PLATE 3, FIGURE 8. Off Curtis Island Bass Straits, off Australia.
1884. *Cellepora granum*. Busk, p. 205; PLATE 36, FIGURE 10. Challenger Sta. 162, off East Moncoeur Island, Bass Strait, 38 fathoms.
1892b. *Cellepora granum*. Hincks, p. 330. Discussion of species likely to be confused with *C. granum*.
1895. *Schismopora granum*. MacGillivray, p. 110; PLATE 14, FIGURE 14. Bairnsdale, Australia.
1904. *Lagenipora granum*. Waters, p. 75.
1905. *Lagenipora lucida* form *nitens*. Waters, p. 241; PLATE 29; FIGURES 15 to 18 (but not his synonymy).
1909. *Lagenipora granum*. Waters, p. 175
1909. *Siniopelta granum*. Levinsen, p. 347
1938. *Siniopelta granum*. Marcus, p. 50

Not the following

1887. *Cellepora granum*. Waters, pp. 198-199.
1889. *Cellepora granum*. Waters, pp. 15, 19-20.
1952. *Celleporina granum*. Brown, pp. 371-373; FIGURE 292

TABLE 8

MEASUREMENTS OF THE PARTS OF *OSTHIMOSIA GRANUM* (HINCKS) 1881*

0.619	– 0.792	(0.698)	H	Zooecia, including peristome
0.374	– 0.648	(0.534)	H	Zooecia, excluding peristome
0.173	– 0.374	(0.289)	H	Peristome
0.216	– 0.259	(0.225)	W	Zooecia at widest part, the base.
0.096	– 0.122	(0.108)	L	Primary orifice
0.101	– 0.122	(0.111)	W	Primary orifice
0.101	– 0.115	(0.107)	L	Operculum
0.101	– 0.122	(0.109)	W	Operculum
0.058	– 0.079	(0.063)	L	Peristomial avicularium, at top
0.043	– 0.058	(0.048)	W	Peristomial avicularium, at top
0.034	– 0.051	(0.044)	L	Peristomial avicularium mandible
0.029	– 0.051	(0.046)	W	Peristomial avicularium mandible
0.102	– 0.174	(0.132)	L	Vicarious avicularium, 6 readings
0.058	– 0.102	(0.078)	W	Vicarious avicularium, 5 readings
0.187	– 0.230	(0.207)	H	Ovicell
0.144	– 0.187	(0.173)	W	Ovicell
		0.131	L	Ancestrula, 2 readings
		0.145	W	Ancestrula, 2 readings
		0.101	L	Vicarious avicularium mandible, 1 reading
		0.072	W	Vicarious avicularium mandible, 1 reading

*Measurements for this species have not been given in past accounts except by Brown (1952), but his fossil *Celleporina granum* is probably a species other than the *Osthimosia granum* of the USN collection.

Osthimosia milleporoides (Calvet) 1909

(TABLES 9 and 10; PLATE 4, FIGURES 43 to 55)

Diagnosis. Colony pisiform. Zooecia erect and immersed in the common zoarial crust. Primary orifice with a wide median proximal notch, but different in shape in ovicelled and nonovicelled zooecia, being approximately hemispherical in the former and more orbicular in the latter. Secondary orifice round to horseshoe-shaped, depending upon the height of the peristome and the small median proximal peristomial avicularium. Peristomial avicularium oval with hemispherical to spatulate mandible and with avicularial chamber a short, thick tube, not clavate. Vicarious avicularia numerous, large, oval. Ovicell decumbent, at right angles to the peristomie, with a crescentic to spatulate tabula, having a peripheral hole at each corner. Peristome and tabula form the secondary orifice over the top of the ovicell. Occasional areolar pores on vicarious avicularial chambers and on zooecia.

The measurements of the various parts are given in TABLE 10.

Zoarium. The colonies are generally small; the largest found measured 6 × 6 × 8 mm. The colonies are opaque, ivory colored, rather hardy, and of variable form. Some are encrusting, some pisiform, and some form a "muff" around various substrates such as alcyonarians, hydroids, and bryozoa. The decumbent ovicells, erect zooecia, interzooecial spaces and vicarious avicularia are crowded confusedly together and are disoriented or in swirls, facing in various directions; only their distal surfaces are distinguishable in the zoarial crust in which they are all immersed. The colonies have a very noticeable swirling or spiral mode of budding, either when viewed from the top or from the basal surface (FIGURES 44, 55).

Zooecia. The erect zooecia are so immersed and crowded together that only their peristomes and orifices show. The peristome is considerably shorter in this species than in the two preceding Celleporids. Its median proximal avicularial chamber is shorter and proportionately broader than in the preceding species. In some zoids the peristome rim may extend beyond the avicularium, so that the avicularium opens into the peristomie on the inner surface of the peristome (FIGURES 49 and 54).

Ovicelled zooecia are numerous in most of the colonies.

Avicularia. As in the preceding species, two distinct avicularial types are present: the peristomial and the vicarious.

The small peristomial avicularium is present on practically every zoid. It has a short, stout avicularial chamber whose basal part is variable in direction (FIGURES 50, 51, and 52). The chamber contains the avicularial organ, glands, and musculature. These contents are weaker and less well developed than those of *Hippadenella carsonae* (Rogick, 1957b). The peristomial avicularium mandible is hemispherical, chitinized, and is provided

with a small lucida (FIGURE 53). The avicularial beak region is considerably larger than the short back membranous area of the avicularium.

Peristomial avicularia in ovicelled zoids may vary somewhat as to the angle or plane at which they are set into the arch of the peristome. Some are horizontal; others are more tangential and within the peristome.

Broadly oval vicarious avicularia are larger than the peristomial type and are especially numerous. They are often arranged in a circle or swirl about zooecial orifices or ovicells. Their membranous back area is short and wide, their beak area is about as long as it is wide, and the lightly chitinized mandible has an oval lucida. Calvet (1909) sketched the peristomial mandible, but not the vicarious mandible.

Orifice. Calvet's material may not have been suitable or sufficient to show that the primary orifice of ovicelled zoids is different in shape and size from that of nonovicelled zoids, since he failed to mention or to illustrate the difference. His sketch of the operculum (PLATE 3, FIGURE 12) is that of a nonovicelled zooecium, and his description of the orifice is based on the same type of zoid.

The primary orifice of both types of zooecia has a wide notch in its median proximal border. In ovicelled zooecia the rest of the primary orifice is somewhat hemispherical; in nonovicelled zooecia it is more orbicular or equal to about three fourths of a circle. The delicate operculum is shaped to fit (FIGURES 46 and 48). As in other *Osthimosia* species, two small dots mark the attachment of the delicate occlusor muscles.

The secondary orifice may be rounded to horseshoe-shaped, depending upon how high the peristomial avicularium extends. In ovicelled zoids the secondary orifice is formed in part by the peristomial wall and in part by the nearest border of the ovicell tabula (FIGURES 43 and 51).

Ovicell. Ovicells are abundant; in some coloniee nearly every zooecium has one. The ovicells are globose, flattened, markedly decumbent, and at right angles to the peristomie. Their surface is smooth except for the salient tabular rim on the upper frontal surface and is nonporous except for the two corner gaps and an occasional hidden peripheral tabular gap. These gaps are not true pores, but areas where the ovicell ectooecium and entooecium do not quite meet. The central part of the crescentic to spatulate tabula is not perforated. Sometimes the tabula is quite long and extensive, occupying from two thirds to three fourths of the ovicell surface.

Zoarial crust. Filling in between zooecia, ovicells, and avicularia are porcellanous perforated plaques or partial walls and large spaces of uncompleted zooecia.

Distribution and ecology. Until this writing, this species has not been reported since its original description by Calvet in 1909. The amount of material in the USN collection is small, but this species occurred at Antarctic stations Nos. 104, 149, 190, 226, 229, 230, 233, 234, and 238 and

from an unidentified locality (Case No. 1). Station No. 104 is in the Ross Sea Area; Station No. 149 is by Peter 1 Island; and the remainder of the stations are on Marguerite Bay. The USN specimens came from depths ranging from 30 to 58 fathoms.

These finds extend considerably the southern and western limits of this species.

Calvet's specimens grew on algae and on *Himantozoum antarcticum* (Calvet) 1909, while the USN specimens had encrusted hydroids, alcyonarians, and the following bryozoan species: *Cellaria moniliorata* and *Escharoides bubeccata* from Station 104, *Hippothoa bougainvillei* from Station 229, *Smittina obicullata* from Station 234, *Notoplites tenuis* from Stations Nos. 104, 226, 229, and 238, and grew on other bryozoans yet to be identified.

TABLE 9

OSTIMOSIA MILLEPOROIDES (CALVET) 1909

SYNONYMY AND PREVIOUSLY REPORTED LOCALITIES

1909. *Cellepora milleporoides*. Calvet, pp. 38 and 39; PLATE 3, FIGURES 11 to 13. Port Charcot (20 to 40 m.) and Booth Wandel, Moureau, and Wyncke Islands.

1957a. *Cellepora milleporoides*. Rogick, p. 8. Marguerite Bay, Station 234.

TABLE 10

MEASUREMENTS OF THE PARTS OF *OSTHIMOSIA MILLEPOROIDES* (CALVET) 1909*

0.461 – 1.008	(0.742)	L	Zooecia, measured on the underside of the colony
0.216 – 0.446	(0.302)	W	Zooecia, measured on the underside.
0.216 – 0.302	(0.262)	L	Ovicell
0.187 – 0.274	(0.235)	W	Ovicell
0.122 – 0.158	(0.138)	L	Secondary orifice of ovicelled zoids
0.101 – 0.158	(0.126)	W	Secondary orifice of ovicelled zoids
0.173 – 0.216	(0.196)	L	Secondary orifice of nonovicelled zoids
0.166 – 0.216	(0.192)	W	Secondary orifice of nonovicelled zoids
0.072 – 0.086	(0.080)	L	Peristomial avicularium of ovicelled zoids
0.065 – 0.086	(0.076)	W	Peristomial avicularium of ovicelled zoids
0.166 – 0.202	(0.184)	L	Vicarious avicularia
0.115 – 0.158	(0.141)	W	Vicarious avicularia
0.101 – 0.130	(0.114)	L	Mandible of vicarious avicularia
0.101 – 0.130	(0.114)	W	Mandible of vicarious avicularia
0.039 – 0.057	(0.048)	L	Mandible of peristomial avicularia
0.058 – 0.085	(0.069)	W	Mandible of peristomial avicularia
0.144 – 0.178	(0.165)	L	Operculum of nonovicelled zoids
0.137 – 0.163	(0.152)	W	Operculum of nonovicelled zoids
0.072 – 0.086	(0.079)	L	Operculum of ovicelled zoids
0.101 – 0.115	(0.104)	W	Operculum of ovicelled zoids

*Calvet included no measurements for *C. milleporoides*, so the following are new.

SUMMARY

(1) The genus *Osthimosia* Jullien 1888 has been emende ly defined, and its controversial status clarified.

(2) The two *Osthimosia* species of Jullien 1888, *O. otopeta* and *O. evexa*, for which the genus was erected, appear to be so similar to the USN specimens of *O. bicornis* (Busk) 1881 and *O. eatonensis* (Busk) 1881, respectively, that they can be considered as synonyms of Busk's species.

(3) Four *Osthimosia* species, *O. bicornis*, *O. eatonensis*, *O. granum* (Hincks) 1881, and *O. milleporoides* (Calvet) 1909 were collected by the United States Navy's 1947-1948 Antarctic Expedition (Commander D. C. Nutt, collector) and are here reported from new Antarctic localities.

(4) All four species have thus far been reported only from the southern hemisphere. The USN collection extended considerably the known southern range of all four.

(5) In addition, the western range of *O. milleporoides* and the eastern range of *O. bicornis* have also been extended.

(6) *Osthimosia eatonensis* is circumpolar in distribution.

(7) Careful study of the four species settled several controversial points or ambiguities that had plagued or misled previous workers.

(8) Each species has been carefully illustrated. Ovicells of *O. eatonensis* and the ancestrula of *O. granum* are shown for the first time.

(9) Measurements of all diagnostic structures have been made for each species. None existed before.

(10) The ancestrula type of this genus has been found and described.

APPENDIX 1: GLOSSARY

ANCESTRULA. The first or beginning individual of a colony, from which a colony buds; formed by the metamorphosis of the larva. See FIGURE 29.

AREOLAE. Marginal pores in the calcareous front wall of an individual. See FIGURE 21

AVICULARIAL CHAMBER. Chamber housing the muscles which control movements of the mandible. It may also house a degenerate polypide and avicularial glands, if such are present in the species. See FIGURES 8, 10, 16, 17.

AVICULARIA. Special heterozoids consisting of avicularial chamber and mandible. See FIGURES 10, 12, 19, 41, 42.

ADVENTITIOUS AVICULARIA. Those which are on or in a regular zoid of the colony and are a part of it. See FIGURES 5, 20, 42.

VICARIOUS AVICULARIA. Those which either replace a regular zoid of a colony or are located between the regular zoids and are independent of them. See FIGURES 1, 10, 16, and 18.

AVICULIFEROUS Having or bearing an avicularium.

BACK AREA. The region of the avicularium which is covered by a membrane that extends backward from the mandible. See FIGURES 16, 18, and 47.

BASAL SURFACE. The surface by which the individual attaches to the substratum. See FIGURES 13 and 44.

BEAK OR ROSTRUM. The more prominent part of the avicularium that the mandible covers. See FIGURES 12, 18 and 47.

DISTAL. Usually, the part farthest from the ancestrula, but sometimes used to refer to the point farthest from some other chosen point.

ECTOOECIUM. The outer layer, often calcareous, of an ovicell. See FIGURES 19, 30, and 37.

ENTOOECIUM. The inner calcareous layer of an ovicell. See FIGURES 19, 30, and 37.

FRONTAL SURFACE. The surface opposite the basal wall. The zooecial orifice may open either on the frontal surface or terminally. See FIGURE 21.

MANDIBLE. A special operculum or chitin-reinforced membrane covering the opening in the avicularial beak. See FIGURES 15, 23, 26, 28, and 53.

NONOVICELLED ZOIDS. Individuals not having an ovicell. Sometimes called autozoids or sterile zoids in some species. See FIGURES 22, 36.

OCCLUSOR MUSCLES. The muscles that attach to the operculum. See FIGURES 2 and 24.

OPERCULUM. A membranous or chitinized cover for the primary orifice. It opens like a drawbridge to permit the extrusion of the tentacles. See FIGURES 2, 14, 25 and 46.

OPESIUM. The membrane-covered opening into the body cavity. Bordered by a cryptocyst. It may either coincide with or be larger than the primary orifice. See FIGURE 29.

ORIFICE. Opening or aperture.

PRIMARY ORIFICE. Opening in the body wall through which the tentacles are extruded. Covered by an operculum. See FIGURE 5.

SECONDARY ORIFICE. Also called the peristomice. If a collar or peristome is present around the primary orifice, the top of the collar will form the secondary orifice. See FIGURES 43, 49, and 51.

OVICELL. A special chamber or brood pouch for larvae, or embryos. See FIGURES 18, 30, and 35.

OVICELLED or OVICELLIGEROUS. Provided with an ovicell as, for example, an individual zoid that has an ovicell on it. See FIGURES 18, 20, and 33.

PERISTOME. The collar, of varying height, that surrounds the primary orifice of some species. See FIGURES 20, 22, and 33.

PERISTOMICE. The secondary orifice.

PERISTOMIE. The channel enclosed by the peristome, or the passageway between the primary and secondary orifices.

POLYPIDE. Such soft internal parts of a zoid as gut, tentacles, and assorted muscles.

PROXIMAL. That part of the colony or zoid nearest the ancestrula or nearest the point of origin of a zoid.

ROSTRUM. See BEAK, above.

SINUS. The V-shaped notch in the lower lip of the primary orifice. See FIGURES 5 and 11.

TABULA. Here used in the restricted sense as Waters (1913, p. 511) introduced it as a flattened or slightly rounded or specially marked-off area on the front of the ovicell. In *Osthimosia* it is marked off from the rest of the ovicell by a ridge. See FIGURES 20, 30, 31, and 51.

ZOARIUM. The bryozoan colony. See FIGURE 7.

ZOID. General term for an individual of a bryozoan colony.

ZOOECIUM. The exoskeleton, often calcified, of a bryozoan individual or zoid. The zooecia make up the zoarium. Also, the zooecium houses the polypide or soft parts of the zoid.

APPENDIX 2: SYMBOLS USED IN FIGURES

A – Avicularium
B – Back area of avicularium
C – Avicularial chamber
E – Areola or areolar pore
F – Primary orifice
H – Pivot bar of avicularium for articulation of the mandible
K – Walls of new, future zooecia that are just beginning to form
L – Lucida of mandible
M – Tendons of occlusor muscles
O – Ovicell
P – Peristome
R – Rostral or beak area of avicularium
S – Sinus of primary orifice
T – Tabula or area of ovicell where the inner entooecial layer is not covered by the outer ectooecial layer
U – Interzooecial calcified patches representing either walls of future zooecia or secondarily calcified plaques or "filler" material
V – Mature ovicelled zoid
W – A nonovicelled unfinished zooecium
X – A nonovicelled finished zooecium
Y – A nonovicelled zooecium without peristomial avicularia
Z – A nonovicelled zooecium slightly older than X

REFERENCES

BASSLER, R. S. 1953. (G) Bryozoa. *In* R. C. Moore's Treatise on Invertebrate Paleontology. Geol. Soc. Am. pp. i-xiii, G1-G253.

BIDENKAP, O. 1905. Fortegnelse over de arktiske Bryozoer. Bergens Mus. Aarbog (2). No. **9**: 1-79.

BROWN, D. A. 1952. The Tertiary Cheilostomatous Polyzoa of New Zealand. Brit. Museum Nat. Hist. 405 pp.

BUSK; G. 1859. A monograph of the fossil Polyzoa of the Crag. Mon. Paleontol. Soc. London, xiii and 136 pp.

BUSK, G. 1881a. Descriptive Catalog of the species of *Cellepora* collected on the "Challenger" Expedition. J. Linn. Soc. Zool. **XV**: 341-356.

BUSK, G. 1881b. Supplementary Note respecting the Use to be made of the chitinous organs in the Cheilostomata in the diagnosis of species, and more particularly in the Genus *Cellepora*. J. Linn. Soc. Zool. **XV**: 357-362.

BUSK, G. 1884. Report on the Polyzoa collected by H.M.S. Challenger ... Part I, The Cheilostomata. Rept. Sci. Research H.M.S. Challenger, Zool. **X**(30): 1-216.

CALVET, L. 1904. Bryozoen. Hamburg. Magalhaens. Sammelr. 45 pp.

CALVET, L. 1909. Bryozoaires. Exped. Antarct. Franc. (1903-1905)... 50 pp. Charcot. Paris, France.

CANU, F. & R. BASSLER. 1920. North American Early Tertiary Bryozoa. Smithsonian Inst. U.S.N.M. Bull. **106**: 1-879.

HINCKS, T. 1881a. VI. Polyzoa from Bass's Strait. Ann. Mag. Nat. Hist. (5) **8**: 1-14; Pls. I-IV.

HINCKS, T. 1881b. XV. Contributions towards a general History of the Marine Polyzoa. Ann. Mag. Nat. Hist. (5) **8**: 122-136; Pls. I-IV.

HINCKS, T. 1892a. The Polyzoa of the St. Lawrence: A study of Arctic forms Ann. Mag. Nat. Hist. (6) **9**: 149-157; Pl. VIII.

HINCKS, T. 1892b. L. Contributions towards a General History of the Marine Polyzoa. Ann. Mag. Nat. Hist. (6) **9**: 327-334.

JULLIEN, J. 1888. Mission scientifique du Cap Horn, 1882-83, VI. Zoologie, 1888 Bryozoaires. 92 pp.; Pls. I-XV.

LEVINSEN, G. M. R. 1909. Morphological and systematic studies on the Cheilostomatous Bryozoa. 431 pp. Copenhagen, Denmark.

LIVINGSTONE, A. 1928. The Bryozoa, in Mawson's Australas. Antarct. Exped. 1911-1914. Ser. C. Zool. Botany. **9**(1) : 1-93.

LORENZ, L. VON, 1886. Bryozoen von Jan Mayen. Die Internat. Polarforsch. 1882-83, Die Oesterreich. Polarstat. Jan Mayen, III: 83-100. Pl. VII.

MACG ILLIVRAY, P. H. 1888. Polyzoa. McCoy's Prodromus Zool. Victoria, Decade XVI: 209-220; Pls. 156-158.

MACGILLIVRAY, P.H. 1895. A monograph of the Tertiary Polyzoa of Victoria. 166 pp.

MARCUS, E. 1938. Bryozoarios marinhos Brasileiros II. Univ. Sao Paulo, Bol. Faculd. Philosoph. Sci. e Letr. IV. Zool. No. **2**: 1-196.

ROGICK, M. D. 1956a. Studies on marine Bryozoa V. Trans. Am. Microscop. Soc. **75**(1): 70-74.

ROGICK, M. D. 1956b. Bryozoa of the U.S. Navy's 1947-48 Antarctic Expedition, I-IV. Proc. U.S. Natl. Museum. **105**(3358): 221-317.

ROGICK, M.D. 1957a. Studies on marine Bryozoa IX. Ohio J. Sci. **57**(1) : 1-9.

ROGICK, M.D. 1957b. Studies on marine Bryozoa X. Biol. Bull. **112**(1): 120-131.

SILÉN, L. 1942. On the spiral growth of the zoaria of certain Bryozoa. Arkiv. Zool. **34A** (2): 1-22.

THORNELY, L. R. 1924. Polyzoa. Australas. Antarct. Exped. 1911-14, Ser. C. Zool. Botany. **6**(6): 1-23.

WATERS, A. W. 1887. Bryozoa from New South Wales, North Australia, & c. Part II. Ann. Mag. Nat. Hist. (5) **20**:: 181-203; Pls. 5, 6.

WATERS, A. W. 1888. Supplementary Report on the Polyzoa collected by H.M.S. *Challenger*. Rept. Sci. Research. H.M.S. *Challenger*, Zool. **XXXI**(79): 41 pp.

WATERS, A. W. 1889. Bryozoa from New South Wales, IV. Ann. Mag. Nat. Hist. (6) **4**: 1-24; Pls. 1-3.

WATERS, A. W. 1900. Bryozoa from Franz-Josef Land. . .Cheilostomata. Jour. Linn. Soc. Zool. London, 28: 43-105; Pls. 7-12.

WATERS, A. W. 1904. Bryozoa. Exped. Antarct. Belge. Result. Voy. du S. Y. Belgica en 1897-99. . . Rappt. Sci. Zool. 114 pp.

WATERS, A. W. 1905. Bryozoa from near Cape Horn. J. Linn. Soc. Zool. London. **29**: 230-251; Pls. 28,29.

WATERS, A. W. 1909. Reports on the marine biology of the Sudanese Red Sea. . . Cheilostomata. J. Linn. Soc. Zool. London, **31**: 123-182; Pls. 10-18.

WATERS, A. W. 1913. The marine fauna of British East Africa and Zanzibar. . . Cheilostomata. Proc. Zool. Soc. London, **1913**: 456-537; Pls. 64-73.

PLATES 1 TO 4

PLATE 1

All FIGURES on this PLATE are of *Osthimosia bicornis* (Busk) 1881, and all but FIGURE 7 were drawn with the aid of a camera lucida. See APPENDIX 2 for symbols used. FIGURES 1, 3, 4, and 6 are drawn to the 0.3-mm.-long scale adjacent to FIGURE 6. FIGURES 2 and 14 are drawn to the 0.1-mm.-long scale above FIGURE 2. FIGURES 5, 8, 10, 11 and 12 are drawn to the 0.1-mm.-long scale to the right of FIGURE 5. FIGURE 9 is drawn to the 0.2-mm.-long scale adjacent to it. FIGURE 13 is drawn to the 1.0-mm.-long scale adjacent to it. FIGURE 15 is drawn to the 0.02-mm.-long scale adjacent to it. See APPENDIX 2 for symbols.

FIGURE 1. Part of a colony showing three ovicelled and four nonovicelled zooecia and a large vicarious avicularium.

FIGURE 2. Operculum, with tendons of occlusor muscles attached to its inner face. Two depressed areas for articulation with orifice cardelles are here outlined by two heavily darkened curved lines.

FIGURE 3. Front view of a zooecium. The two aviculiferous processes give it its name *bicornis*.

FIGURE 4. Front view of zooecium. The two blunted aviculiferous processes are in front, the two sharper peristomial points are more to the back.

FIGURE 5. Top view of nonovicelled zooecium and its primary orifice.

FIGURE 6. Side view of three ovicelled zooecia brings out the angle of junction of ovicell to zooecium, the extent and height of the peristome, and the erectness of the zooecia.

FIGURE 7. A freehand sketch of a colony. The zooecia are characteristically erect, and the colony is small.

FIGURE 8. Side view of peristome and the long avicularial chamber. The operculum (heavily stippled disc) that covers the primary orifice is in its proper position at the bottom of the peristomie.

FIGURE 9. Top view of a variety of young zooecia (V, W, X, Y, and Z) and the zoarial crust (U). Zooecium V has a fairly large tabula for this species. Its peristome has not yet developed the points characteristic of the older zooecia of FIGURE 6. W is younger, still without a peristome, but with avicularia. Slightly older X has both peristome and avicularia developed. Y has an equally well-developed peristome, but lacks the avicularia, an unusual condition. Z is slightly older than X. The zoarial crust in which the zooecia are immersed may consist of newly forming zooecial walls, like the two large-holed areas between Zooecia V, W, and Z, or may consist of fairly solid calcified plaques, as at lower right between zooecia Y and Z. A spiral growth habit is here suggested.

FIGURE 10. A vicarious avicularium from calcined specimen. Its avicularial chamber is large.

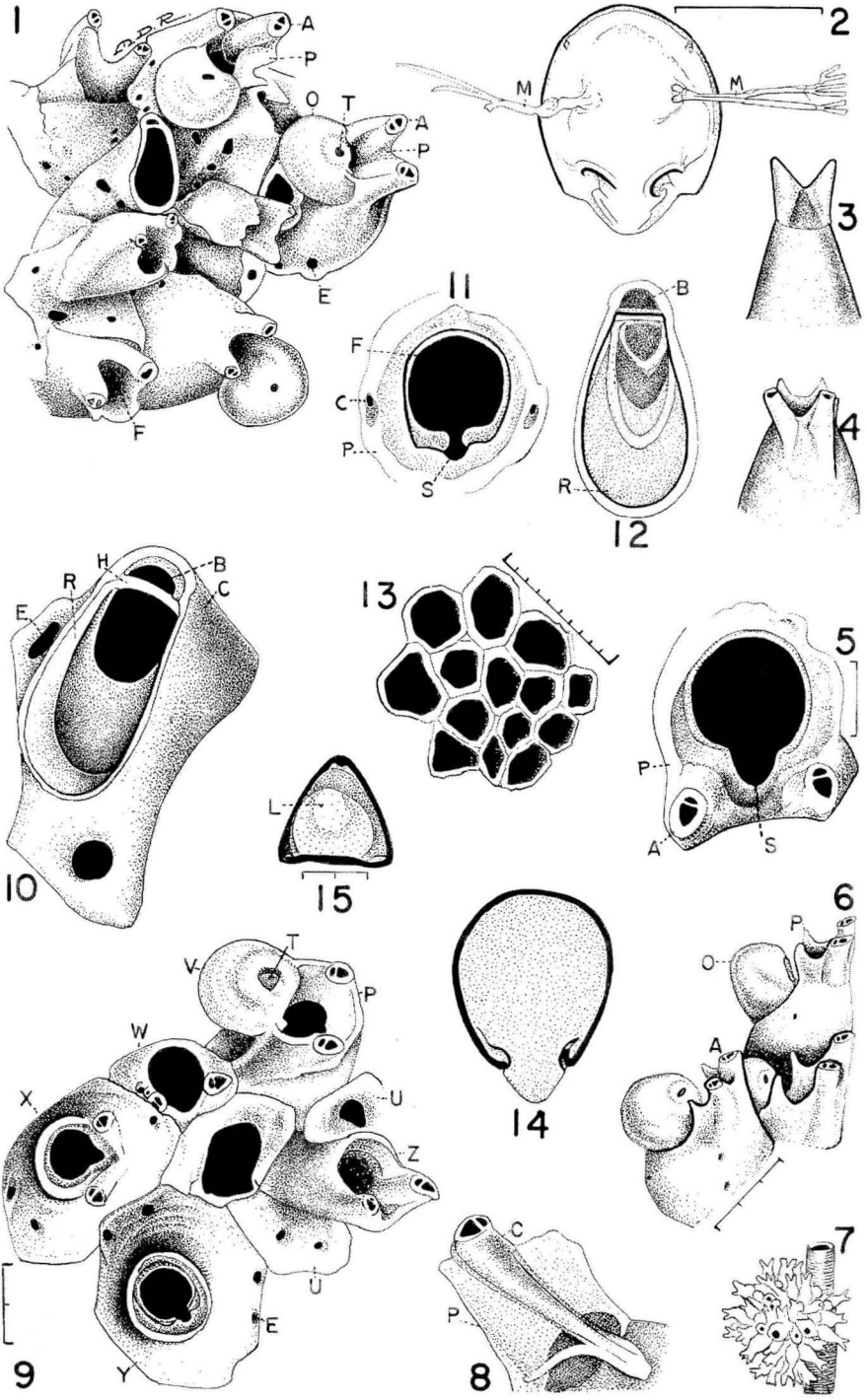
FIGURE 11. Top view of primary orifice of young zooecium taken just above the level of the operculum (compare FIGURE 8). The inner ledges or cardelles of the orifice are for the articulation of the operculum (compare FIGURE 2). The sinus is more pedunculate than that of FIGURE 5. The avicularial chambers are much narrower and more lateral at this level than higher up (compare FIGURES 5 and 8).

FIGURE 12. Top view of rim and mandible of uncalcined vicarious avicularium. The heavily outlined spatulate mandible is lightly stippled. The two loops are chitinized reinforcements.

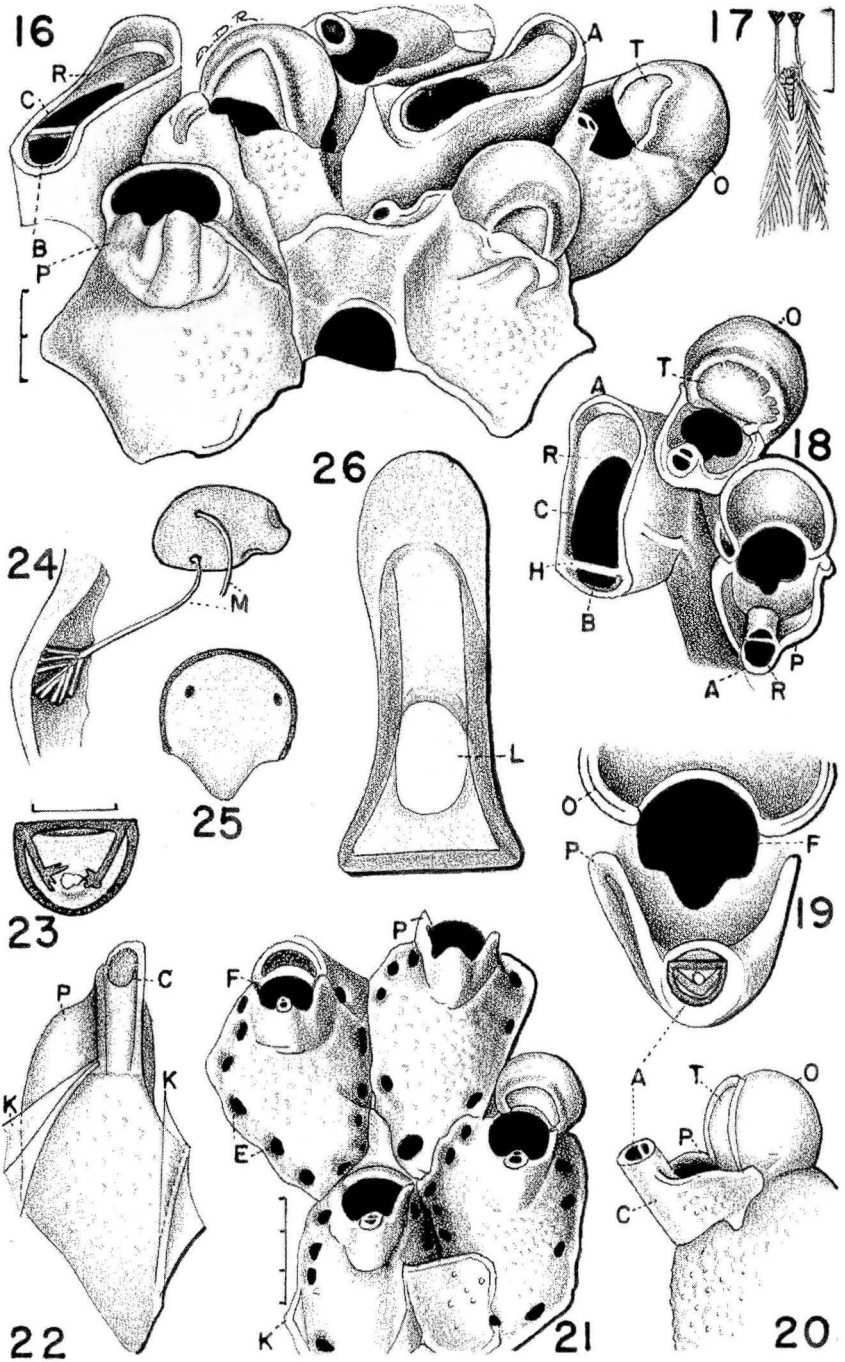
FIGURE 13. The attached underside of 14 zooecia, showing the relative thickness of zooecial walls about the base.

FIGURE 14. An operculum of slightly different shape from that pictured in FIGURE 2.

FIGURE 15. Trianguloid mandible of peristomial avicularium.



ROGICK: OSTHIMOSIA BICORNIS



ROGICK: OSTHIMOSIA EATONENSIS

PLATE 2

All drawings on this PLATE are of *Osthimosia eatonensis* (Busk) 1881, and were made with the aid of a camera lucida. See APPENDIX 2 for symbols used.

The 0.2 mm. long scale at left of FIGURE 16 applies to FIGURES 16, 18, 20, 22; the 0.1-mm.-long scale at right of FIGURE 17 applies to FIGURES 17, 19, 24, 25, and 26. FIGURE 21 is drawn to the adjacent 0.3-mm.-long scale. FIGURE 23 is drawn to the adjacent 0.05-mm.-long scale.

FIGURE 16. One nonovicelled zooecium, two large vicarious avicularia, and three ovicelled zooecia from the crowded part of a well-calcified calcined colony. The ovicell tabula is trianguloid.

FIGURE 17. Side view of two bundles of adductor mandibuli muscles and their tendons that attach to the peristomial avicularium mandible. These bundles are in the elongated chamber of the peristomial avicularium (compare FIGURE 22).

FIGURE 18. Top view of two calcined ovicelled zooecia and a vicarious avicularium. The front wall of the right ovicell is broken off, exposing the interior. The left ovicell has a rather hemispherical tabula.

FIGURE 19. Top view of a zooecium whose ovicell is broken. The two layers (ectooecium and entooecium) of the ovicell are evident. A mandible is in place over the avicularial chamber.

FIGURE 20. Side view of an ovicelled zooecium. The ovicell is typically erect, and the peristome is spoutlike or urceolate.

FIGURE 21. Front view of four young, decumbent conspicuously areolated zooecia from near the outer margins of a colony. The second stratum of more erect zoids is already forming, as evidenced by the calcareous lamina growing between the bases of the zooecial pairs. An ovicell is forming in the upper left zooecium.

FIGURE 22. Front view of an erect zoid that has a very tall hyaline peristome and clearly defined avicularial chamber. The delicate laminae of future zooecia (K) are extremely transparent.

FIGURE 23. Mandible of peristomial avicularium.

FIGURE 24. Operculum attached by occlusor muscles to part of the zooecial wall.

FIGURE 25. Operculum with chitinized rim and the two muscle-attachment dots.

FIGURE 26. Mandible of vicarious avicularium.

PLATE 3

All FIGURES on this PLATE are of *Osthimosia granum* (Hincks) 1881, and were made with the aid of a camera lucida. See APPENDIX 2 for symbols used.

The 0.1-mm.-long scale at the left of FIGURE 27 applies to FIGURES 27, 31, 34-36, and 38-42. FIGURE 28 is drawn to the adjacent 0.05-mm.-long scale. The 0.1-mm.-long scale to the right of FIGURE 29 applies to FIGURES 29 and 30. The 0.2-mm.-long scale to the right of FIGURE 32 applies to FIGURES 32 and 33.

FIGURE 27. Front view of ovicell, peristomial avicularium, and very low peristome of a young individual. The transparency of the peristome permits one to see both layers of the peristome and the median avicularial chamber.

FIGURE 28. Mandible of peristomial avicularium.

FIGURE 29. Spined ancestrula and parts of several unfinished young zooecia.

FIGURE 30. An ovicell whose visorlike front is flattened a little below the tabula. The two layers (ectooecium and entooecium) that make up the ovicell wall are visible at the back of the translucent ovicell at the extreme right in the sketch.

FIGURE 31. Front view of a young ovicell with a typical hemispherical tabula.

FIGURE 32. A fragment of a colony. The tall peristomes, the clavate avicularial chambers, and the upright zooecia are characteristic for this species. Areolar pores are few in number.

FIGURE 33. Back view of two ovicelled zooecia with very tall, although rather narrow, peristomes. The peristome wings are not yet fully developed laterally, especially in the lower zoid.

FIGURE 34. Ovicelled zooecium with unusually thick glassy peristomial wings that curve forward at the edges, a rather unusual type of curvature.

FIGURE 35. Ovicell with an embryo (the dark ball) in it. The peristomial wings are poorly developed near the avicularium. The tabula border is barely visible over the orifice. The zooecial neck is unusually narrow.

FIGURE 36. A zooecium with two peristomes and two avicularia, an unusual condition.

FIGURE 37. Back view of an ovicelled zoid whose peristome is unusually obstructive and whose double wall is plainly evident. The junction of ovicell to zooecium, in the "nape of the neck" region is slightly different from that of FIGURES 33 and 35.

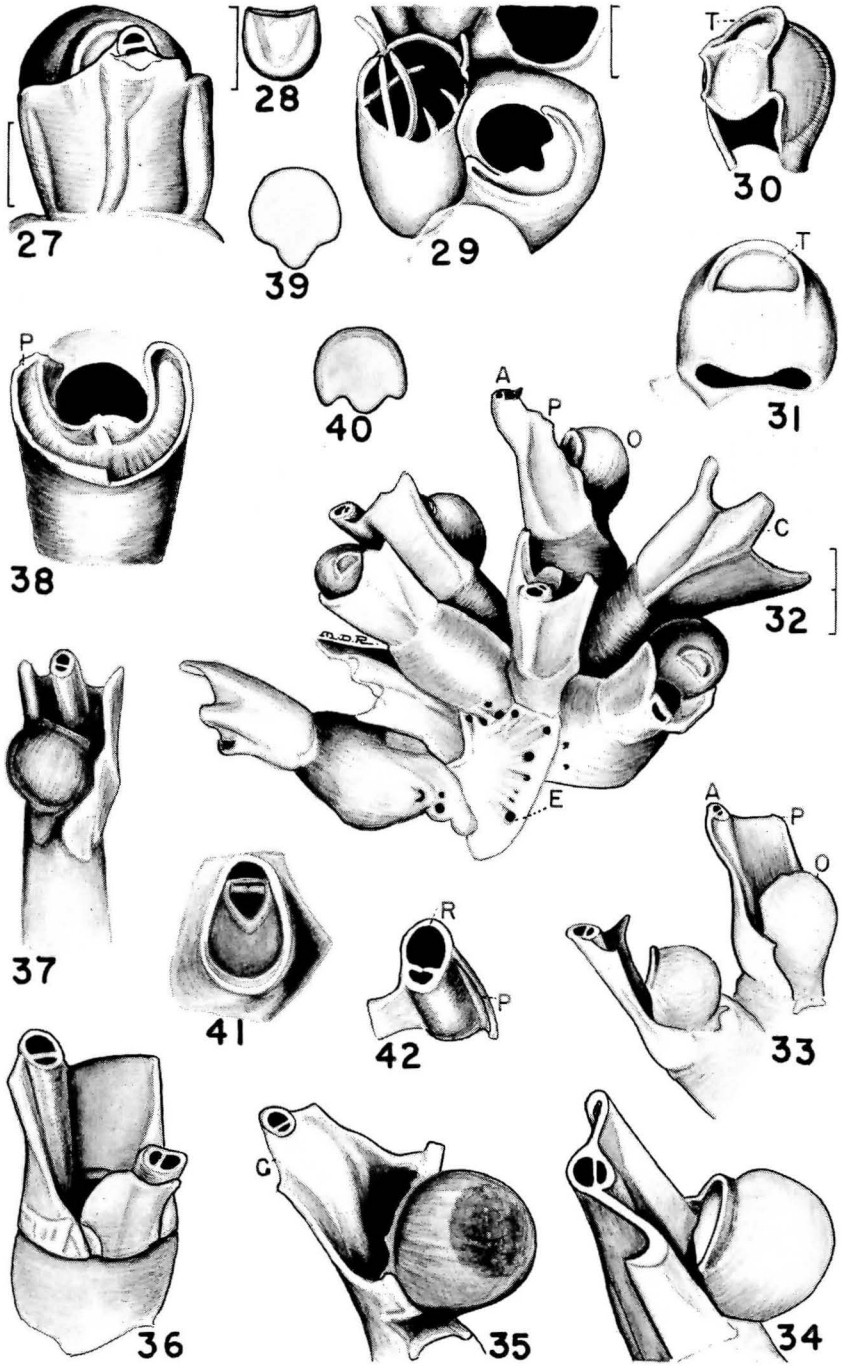
FIGURE 38. Front view of a young unfinished zooecium. The two laminae of the just-forming peristome are rather widely separated at this basal level. The lappet or median thickening in the lamina nearest the orifice is the anlage of the avicularial chamber.

FIGURE 39. Operculum.

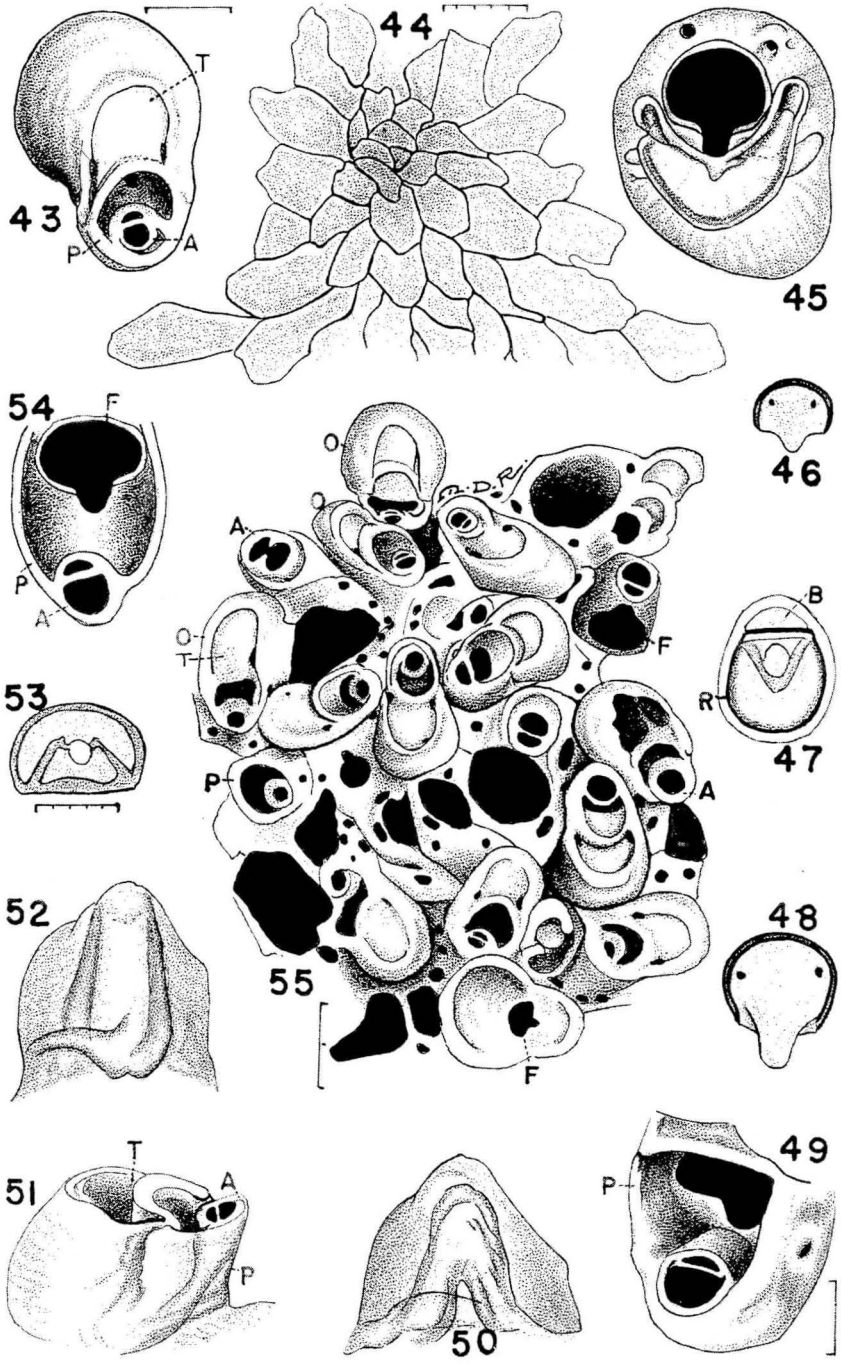
FIGURE 40. Operculum of a slightly different shape.

FIGURE 41. Vicarious avicularium with mandible in place.

FIGURE 42. Peristomial avicularium.



ROGICK: OSTHIMOSIA GRANUM



ROGICK: OSTHIMOSIA MILLEPOROIDES

PLATE 4

All FIGURES on this PLATE are of *Osthimosia milleporoides* (Calvet) 1909 and were made with the aid of a camera lucida. See APPENDIX 2 for symbols used.

The 0.1-mm-long scale above FIGURE 43 applies to FIGURES 43, 46-48, 50, and 52. FIGURE 44 is drawn to the 0.5-mm.-long scale directly above it. The 0.1-mm.-long scale to the right of FIGURE 49 applies to FIGURES 45, 49, 51, and 54. FIGURE 53 is drawn to the 0.05-mm.-long scale immediately below it. FIGURE 55 is drawn to the 0.2-mm.-long scale adjacent to it.

FIGURE 43. Top of ovicell and peristome. The rounded peristomice is formed by the peristome rim and the lower border of the tabula. A tip of the primary orifice sinus is barely visible far back behind the avicularium. The two corner holes of the ovicell are not true pores, but gaps between the ectooecial and entooecial layers of the ovicell.

FIGURE 44. Part of a colony seen from the basal attached surface. The zooecia in the darker area are crowded together and upright while the marginal zooecia are more decumbant.

FIGURE 45. A young zooecium with developing peristome. Behind the orifice are pores which continue as tubes down into the zooecial walls.

FIGURE 46. Operculum of ovicelled zooecium, typically shorter than that of nonovicelled zoids.

FIGURE 47. Rim of vicarious avicularium with heavily outlined mandible in place.

FIGURE 48. Operculum of nonovicelled zooecium.

FIGURE 49. Peristome, avicularium, and orifices (primary and secondary) of a nonovicelled zooecium. Avicularial chamber is better developed and peristome is thicker than those of FIGURE 54.

FIGURE 50. Front view of a peristome with symmetrically bifid avicularial chamber.

FIGURE 51. Side view of a heavily calcified ovicell, peristome, and secondary orifice. The tabula is deeply sunken.

FIGURE 52. Front view of peristome and less symmetrical avicularial chamber than that of FIGURE 50. This is a more usual condition.

FIGURE 53. Mandible of peristomial avicularium.

FIGURE 54. Primary orifice, peristome, and avicularium of young ovicelled zooecium whose ovicell was incomplete and not shown here.

FIGURE 55. Top view of a patch of colony with numerous ovicelled zooecia, many vicarious avicularia, and a considerable amount of zoarial crust (calcified interzooecial plaques or developing zooecial walls).

MONOGRAPHIC PUBLICATIONS

OF

THE NEW YORK ACADEMY OF SCIENCES

(LYCEUM OF NATURAL HISTORY, 1817–1876)

(1) The ANNALS (octavo series), established in 1823, contain the scientific contributions and reports of researches, together with the records of meetings of the Academy. The articles that comprise each volume are printed separately, each in its own cover, and are distributed immediately upon publication. The prices of the separate articles depend upon their length and the number of illustrations, and may be ascertained upon application to the Executive Director of the Academy.

Current numbers of the ANNALS are sent free to all Members of the Academy desiring them.

(2) The SPECIAL PUBLICATIONS, established in 1939, are issued at irregular intervals as cloth-bound volumes. The price of each volume will be advertised at time of issue.

(3) The MEMOIRS (quarto series), established in 1895, are issued at irregular intervals. It is intended that each volume shall be devoted to monographs relating to some particular department of science. Volume I, Part 1 is devoted to Astronomical Memoirs, Volume II to Zoological Memoirs. No more parts of the Memoirs have been published to date. The price is one dollar per part.

(4) The SCIENTIFIC SURVEY OF PORTO RICO AND THE VIRGIN ISLANDS (octavo series), established in 1919, gives the detailed reports of the anthropological, botanical, geological, paleontological, zoological, and meteorological surveys of these islands.

Subscriptions and inquiries concerning current and back numbers of any of the publications of the Academy should be addressed to

EXECUTIVE DIRECTOR
The New York Academy of Sciences
2 East Sixty-third Street
New York 21, N. Y.